KTL Test Report:

Applicant:

Equipment Under Test (E.U.T.):

FCC ID:

In Accordance With:

Tested By:

Authorized By:

test report

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Section 1. Summary of Test Results

Manufacturer: Rohde & Schwartz Canada Ltd.

Model No.: XU221

Serial No.: 845261/016

General: **All measurements are traceable to national standards.**

These tests were conducted on a sample of the equipment for the purpose of demonstrating compliance with FCC Part 87, Subpart D.

☒ New Submission ☒ Production Unit

☐ Class II Permissive Change ☐ Pre-Production Unit

T | N | B Equipment Code

THIS TEST REPORT RELATES ONLY TO THE ITEM(S) TESTED.

THE FOLLOWING DEVIATIONS FROM, ADDITIONS TO, OR EXCLUSIONS FROM THE TEST SPECIFICATIONS HAVE BEEN MADE.
See " Summary of Test Data".

NVLAP

NVLAP LAB CODE: 100351-0

TESTED BY: Russell Krant DATE: Nov 25, 98

TECHNICAL REVIEW: Tom Tidwell DATE: 25 Nov. 1998
Tom Tidwell, Wireless Group Manager

Summary Of Test Data

NAME OF TEST	PARA. NO.	SPEC.	MEAS.	RESULT
RF Power Output	87.131	25	27.0	Complies
Audio Frequency Response	2.1047	None	Graph	Complies
Audio Low-Pass Filter Response	2.1047	None	Graph	Complies
Modulation Limiting	87.141	100%	Graph	Complies
Occupied Bandwidth	87.139	Graph	Graph	Complies
Spurious Emissions at Antenna Terminals	87.139	-13dBm	Graph	Complies
Field Strength of Spurious Emissions	87.139	75.2 dBµV	< 48dBµV	Complies
Frequency Stability	87.133	20 ppm	0.466	Complies

Footnotes For N/A's:

Test Conditions: Temperature: 20 °C
Humidity: 30 %

Section 2. General Equipment Specification

Transmitter

Supply Voltage Input:	120 VAC
Frequency Range:	118 – 144 MHz
Tunable Bands:	1
Necessary Bandwidth:	6 kHz
Types of Modulation:	AM
Data Rate(s)	Not Applicable
Internal/External Data Source:	Not Applicable
Emission Designator:	6K00A3E
Output Impedance:	50 ohms
RF Power Output (rated):	25 W Unmodulated 35.125 W Fully Modulated 90% Modulated Depth Max
Duty Cycle:	Continuous
Channel Spacing(s):	25 kHz
Operator Selection of Operating Frequency:	None
Power Output Adjustment Capability:	None

Description of Modifications For Class II Permissive Change

NOT APPLICABLE

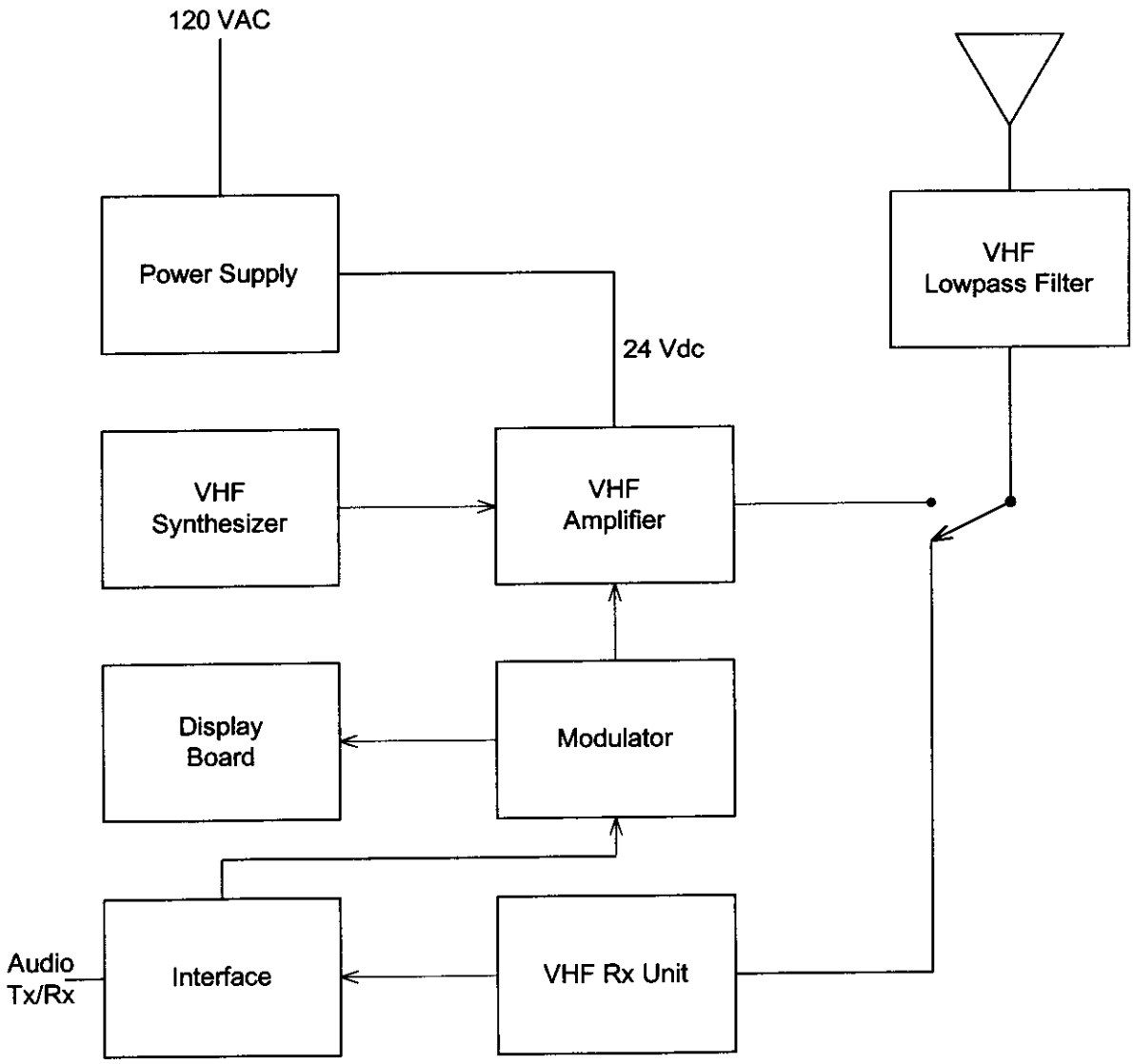
Modifications Made During Testing

NOT APPLICABLE

Theory of Operation

The XU221 VFH transceiver unit is designed for operation in the band 118 – 144 MHz. This equipment uses conventional amplitude modulation, (full carrier, doubled side band). Amplitude modulation is internally limited to 90%. The rated RF power output is 25W unmodulated. During maximum 90% amplitude modulation the RF power output is $\left(1+\frac{0.9}{2}\right)x25=35.125$.

System Diagram



Section 3. RF Power Output

NAME OF TEST: RF Power Output	PARA. NO.: 2.1046
TESTED BY: Russell Grant	DATE: November 20, 1998

Test Results: Complies.

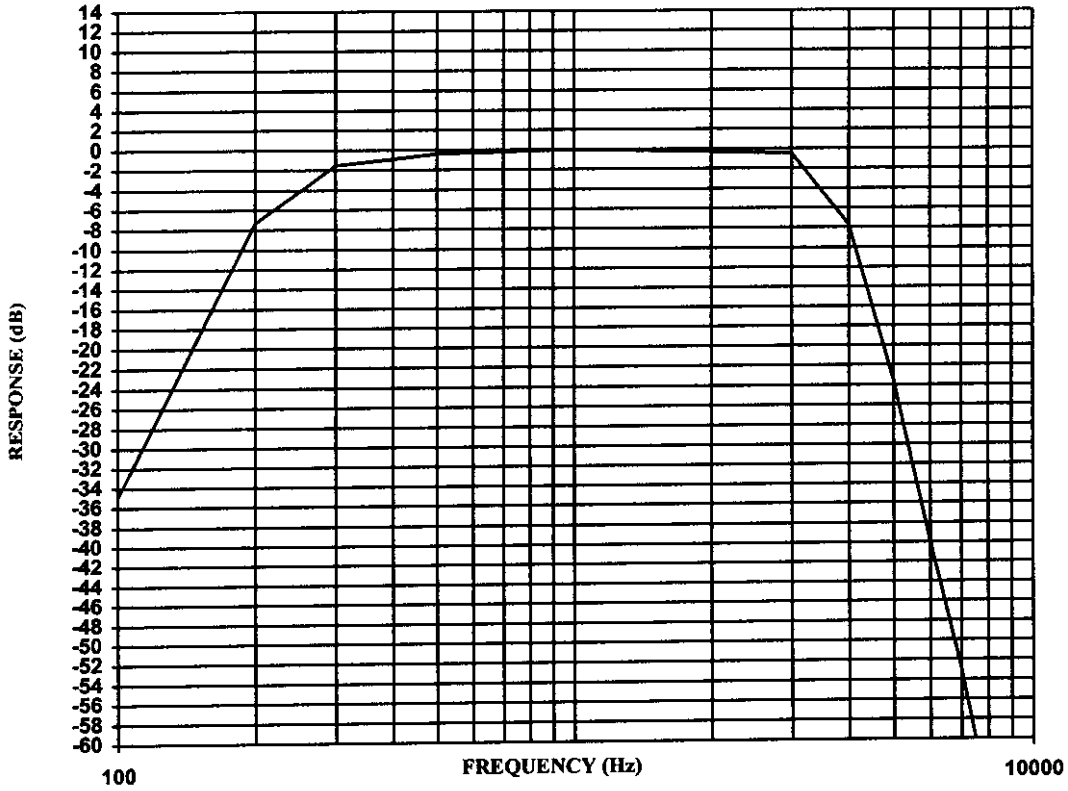
Measurement Data:

Frequency (MHz)	Rated Power (W)	Measured Power (W)	Measured/Rated (dB)
122.4	25 Unmodulated	27.0	+0.3
122.4 *	35.2 Modulated	38.0	+0.3

* The equipment was modulated with a 2500 Hz tone at 90.4 tone at 90.4% modulation depth. This equipment is internally set for a maximum modulation depth of 90%.

Section 4. Audio Frequency Response

NAME OF TEST: Audio Frequency Response	PARA. NO.: 2.1047
TESTED BY: Russell Grant	DATE: November 20, 1998

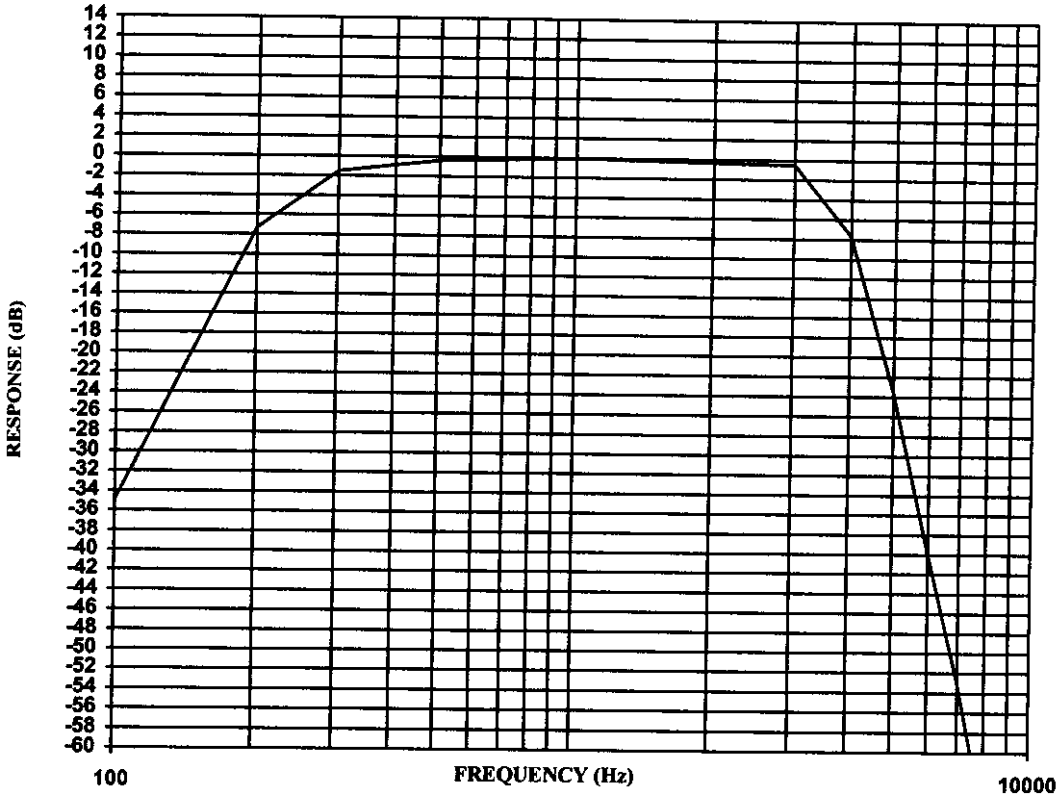


Audio Frequency Response

Frequency (Hz)	100	200	300	400	500	700	1000	2000	3000	4000	5000	6000
Response (dB)	-34.9	-7.3	-1.5	-0.4	-0.2	-0.1	0	-0.3	-0.5	-7.7	-23.6	-40.0

Section 5. Audio Low-Pass Filter Response

NAME OF TEST: Audio Low-Pass Filter Response	PARA. NO.: 2.1047
TESTED BY: Russell Grant	DATE: November 20, 1998

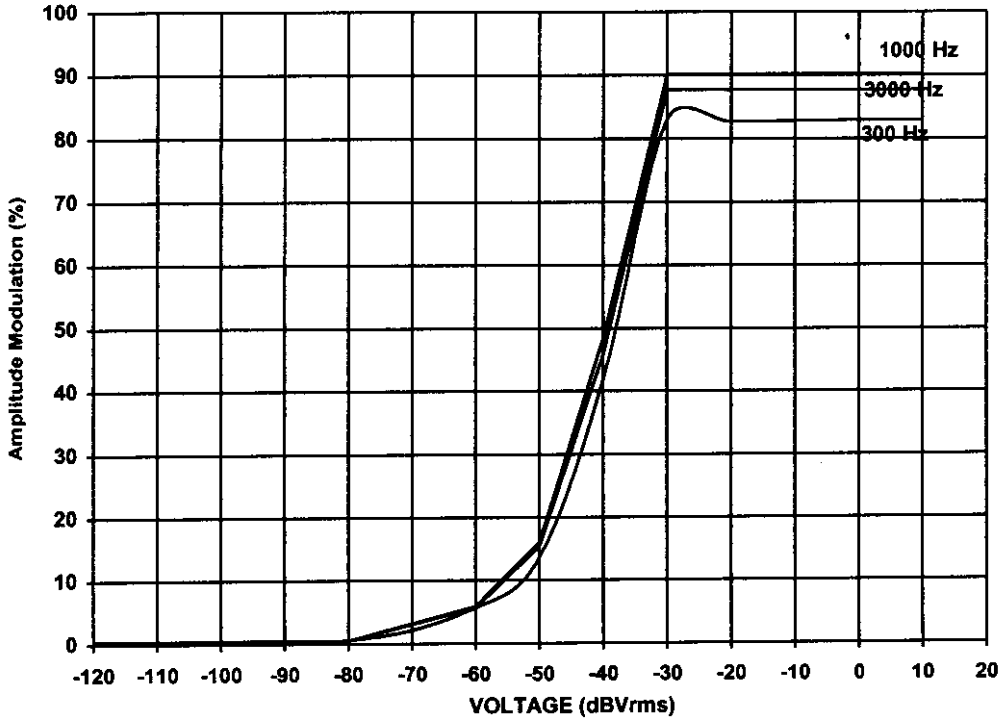


Audio Frequency Response

Frequency (Hz)	100	200	300	400	500	700	1000	2000	3000	4000	5000	6000
Response (dB)	-34.9	-7.3	-1.5	-0.4	-0.2	-0.1	0	-0.3	-0.5	-7.7	-23.6	-40.0

Section 6. Modulation Limiting

NAME OF TEST: Modulation Limiting	PARA. NO.: 2.1047
TESTED BY: Russell Grant	DATE: November 20, 1998



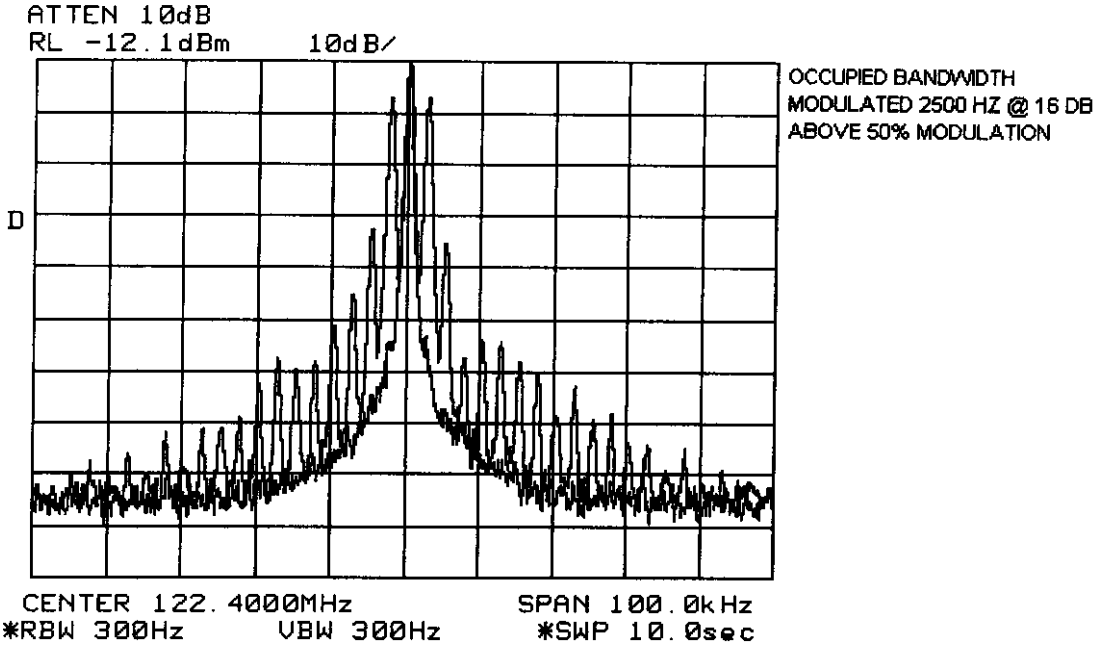
Maximum deviation for non-voice modulation _____ kHz.

Section 7. Occupied Bandwidth

NAME OF TEST: Occupied Bandwidth	PARA. NO.: 2.1047
TESTED BY: Russell Grant	DATE: November 20, 1998

Test Results: Complies.

Test Data: See attached graph(s).


ATTEN 10dB
RL -12.1dBm
10dB/
D
OCCUPIED BANDWIDTH
MODULATED 2500 HZ @ 16 DB
ABOVE 50% MODULATION
CENTER 122.4000MHz
SPAN 100.0kHz
*RBW 300Hz
VBW 300Hz
*SWP 10.0sec

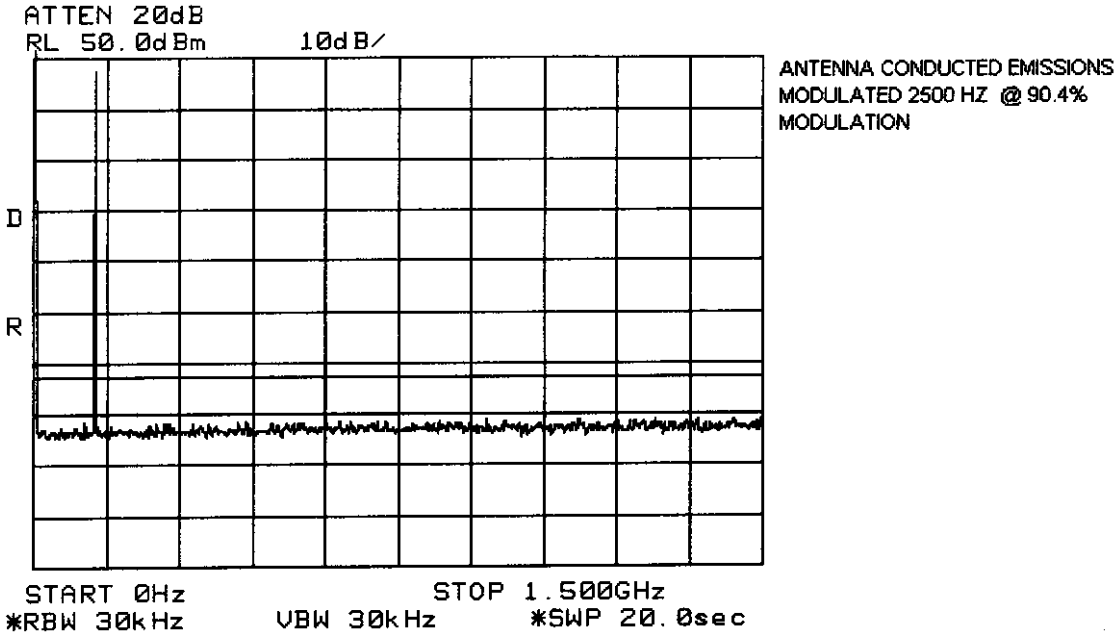
Section 8. Spurious Emissions at Antenna Terminals

NAME OF TEST: Spurious Emissions @ Antenna Terminals	PARA. NO.: 2.1051
TESTED BY: Russell Grant	DATE: November 20, 1998

Test Results: Complies.

Test Data: See attached graph(s).

All emissions < -23 dBm


ATTEN 20dB
RL 50.0dBm
10dB/
D
R
START 0Hz
STOP 1.500GHz
*RBW 30kHz
VBW 30kHz
*SWP 20.0sec
ANTENNA CONDUCTED EMISSIONS
MODULATED 2500 HZ @ 90.4%
MODULATION

Section 9. Field Strength of Spurious Emissions

NAME OF TEST: Field Strength of Spurious Emissions	PARA. NO.: 2.1053
TESTED BY: Russell Grant	DATE: November 20, 1998

Test Results: Complies.

Test Data: No emissions were detected on a outdoor range at a distance of 3m. Our measurement noise floor is 3 dBμV/m at 30 MHz and increases uniformly to 48 dBμV/m at 1500 MHz.

Test Data - Radiated Emissions

Test Distance (meters) : 3		Range:		Receiver:		RBW(kHz):		Detector:			
Freq. (MHz)	Ant. *	Pol. (V/H)	Ant. HGT. (m)	Table (deg.)	RCVD Signal (dBµV/m)	Ant. Factor (dB)**	Amp. Gain (dB)***	Dist. Corr. (dB)	Field Strength (dBµV/m)	Limit (dBµV/m)	Margin (dB)

Notes:
The spectrum was search up to the 10th harmonic of the fundamental frequency.
B/C = Biconical, B/L = Biconilog, L/P = Log-Periodic, H = Horn, D/P = Dipole
* Includes cable loss when amplifier is not used.
** Includes cable loss.
( ) Denotes failing emission level.

Section 10. Frequency Stability

NAME OF TEST: Frequency Stability	PARA. NO.: 2.1055
TESTED BY: Russell Grant	DATE: November 20, 1998

Test Results: Complies.

Measurement Data: See attached tables.

The maximum frequency drift is 57 Hz. This is 0.466 ppm.

Frequency Stability Tables

Time (min)	-30°C	-20°C	-10°C	0°C	+10°C
0	122.400057	122.400048	122.400041	122.400034	122.400023
1	122.400057	122.400048	122.400041	122.400034	122.400023
2	122.400057	122.400048	122.400041	122.400034	122.400023
3	122.400057	122.400048	122.400041	122.400034	122.400023
4	122.400057	122.400048	122.400041	122.400034	122.400023
5	122.400057	122.400048	122.400041	122.400034	122.400023

Time (min)	+20°C	+30°C	+40°C	+50°C	+60°C
0	122.400043	122.399981	122.399977	122.399973	122.399976
1	122.400043	122.399981	122.399977	122.399973	122.399976
2	122.400043	122.399981	122.399977	122.399973	122.399976
3	122.400043	122.399981	122.399977	122.399973	122.399976
4	122.400043	122.399981	122.399977	122.399973	122.399976
5	122.400043	122.399981	122.399977	122.399973	122.399976

Time (min)	85% STV	STV	110% STV
0	122.400043	122.400043	122.400043
1	122.400043	122.400043	122.400043
2	122.400043	122.400043	122.400043
3	122.400043	122.400043	122.400043
4	122.400043	122.400043	122.400043
5	122.400043	122.400043	122.400043

Section 11. Test Equipment List

CAL CYCLE	EQUIPMENT	MANUFACTURER	MODEL	SERIAL	LAST CAL.	NEXT CAL.	
1 Year	Spectrum Analyzer	Hewlett Packard	8565E	FA000981	May 20/98	May 20/99	
1 Year	Radio Test Set	Rohde & Schwarz	CMS 52	840.0009.52	July 23/98	July 23/99	
1 Year	Climate Chamber	Thermotron	SM-16C	15649-S	Aug. 7/98	Aug. 7/99	
1 Year	Selective Level Meter	Hewlett Packard	3586B	1928A01971	July 12/98	July 12/99	
1 Year	Attenuator	Narda	768-20	9507	July 24/98	July 24/99	
1 Year	Attenuator	Narda	765-20	9510	July 24/98	July 24/99	
1 Year	Attenuator	Narda	768-10	9704	July 24/98	July 24/99	
1 Year	Attenuator	Narda	768-10	9709	July 24/98	July 24/99	
1 Year	RF Millivoltmeter	Rohde & Schwarz	URV5	FA000420	July 23/98	July 23/99	
1 Year	Insertion Unit	Rohde & Schwarz	URV5-Z4	FA000905	July 23/98	July 23/99	
1 Year	Power Sensor	Rohde & Schwarz	URV5-Z5	FA000419	July 23/98	July 23/99	
1 Year	Receiver	Rohde & Schwarz	ESVP	892661/014	Mar. 31/98	Mar. 31/99	
2 Year	Horn Antenna	EMCO #2	3115	4336	Oct. 30/97	Oct. 30/99	
1 Year	Log Periodic Antenna	EMCO	LPA-25	1141	July 27/98	July 27/99	
1 Year	Biconical (1) Antenna	EMCO	3109	9204-2708	July 27/98	July 27/99	
1Year	Frequency Counter	Hewlett Packard	HP5350A	2444A00135	Mar. 27/98	Mar. 27/99	

NA: Not Applicable
NCR: No Cal Required

ANNEX A

TEST METHODOLOGIES

NAME OF TEST: RF Power Output	**PARA. NO.: 2.1046**

Minimum Standard: Para. No.87.131. Variable as per authorized emissions.

Method Of Measurement:

Detachable Antenna:
The average power at antenna terminals is measured using an in-line power meter.

Integral Antenna:
If the antenna is not detachable from the circuit then the Power Output is derived from the radiated field strength of the fundamental emission by using the plane wave relation $GP/4\pi R^2 = E^2/120\pi$ and proceeding as follows:

$$P = \frac{E^2R^2}{30G} = \frac{E^2 3^2}{30G}$$

where,

P = the equivalent isotropic radiated power in watts
E = the maximum measured field strength in V/m
R = the measurement range (3 meters)
G = the numeric gain of the transmit antenna in relation to an isotropic radiator

NAME OF TEST: Audio Frequency Response	**PARA. NO.: 2.1047**

Test Method: TIA/EIA-603

Minimum Standard: Not Applicable

NAME OF TEST: Audio Low-Pass Filter Frequency Response	**PARA. NO.: 2.1047**

Test Method: TIA/EIA-603

Minimum Standard: Not Applicable

NAME OF TEST: Modulation Limiting	**PARA. NO.: 2.1047**

Test Method: TIA/EIA-603

Minimum Standard: Para. No. 87.141 100%

NAME OF TEST: Occupied Bandwidth	**PARA. NO.: 2.1049**

Minimum Standard: Para. No. 87.139 (a).

Test Method:

RBW: 1% of emission bandwidth in 0 - 1 GHz range. 1 MHz at frequencies above 1 GHz.
VBW: $\Rightarrow$ RBW

NAME OF TEST: Field Strength of Spurious	**PARA. NO.: 2.1053**

Minimum Standard: Para. No. 87.139(a)..

Calculation of Field Strength Limit

An example of attenuation requirement of 43 + 10 Log P is equivalent to (5×10^{-5} Watts) at the antenna terminal. We determine the field strength limit by using the plane wave relation.

$GP/4\pi R^2 = E^2/120\pi$

For emissions ≤ 1 GHz:

G = 1.64 (Dipole Gain)
P = 10^{-5} Watts (Maximum spurious output power)
R = 3m (Measurement Distance)

$$E = \frac{\sqrt{30GP}}{R} = \text{E} = \frac{\sqrt{30 \times 1.64 \times (5 \times 10^{-5})}}{3} = 0.0165\ \text{V/m} = 84.3\ \text{dB}\mu\text{V/m}$$

For emissions > 1 GHz:

G = 1 (Isotropic Gain)
P = 1 x 10^{-5} Watts (Maximum spurious output power)
R = 3m (Measurement Distance)

$$E = 84.3 - 20Log\sqrt{1.64} = 82.2dB\mu V / m @ 3m$$

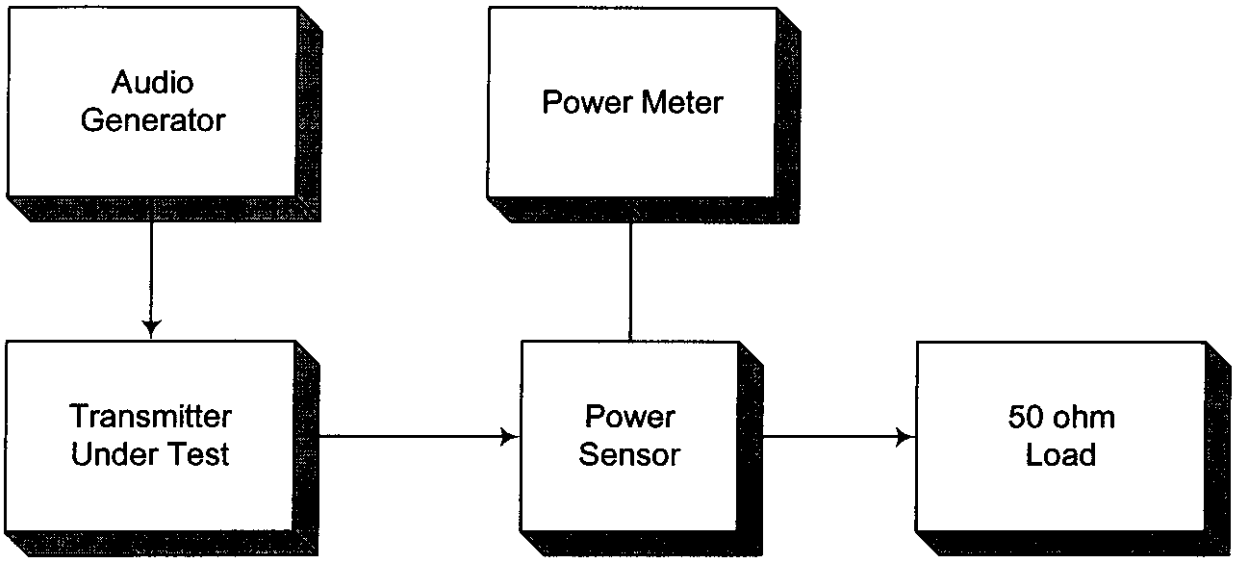
NAME OF TEST: Frequency Stability	**PARA. NO.: 2.1055**

Minimum Standard: Para. No. 87.133.

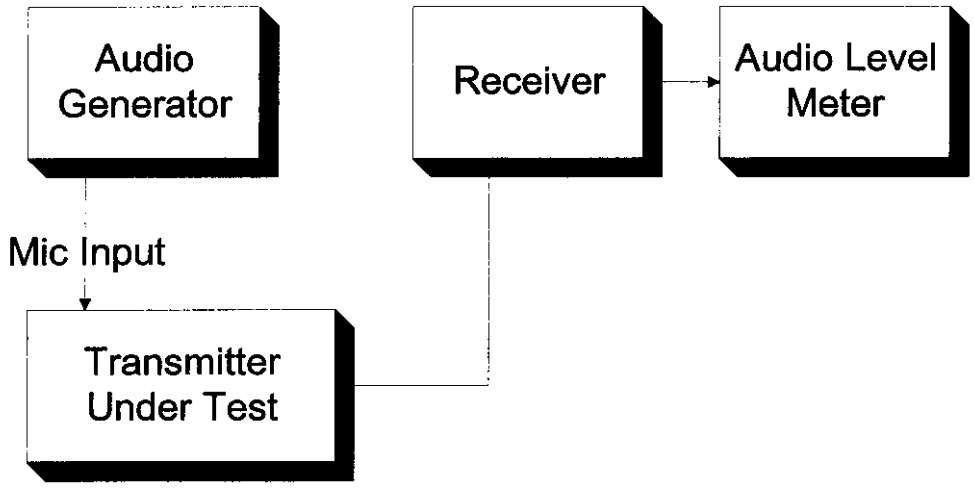
ANNEX B

TEST DIAGRAMS

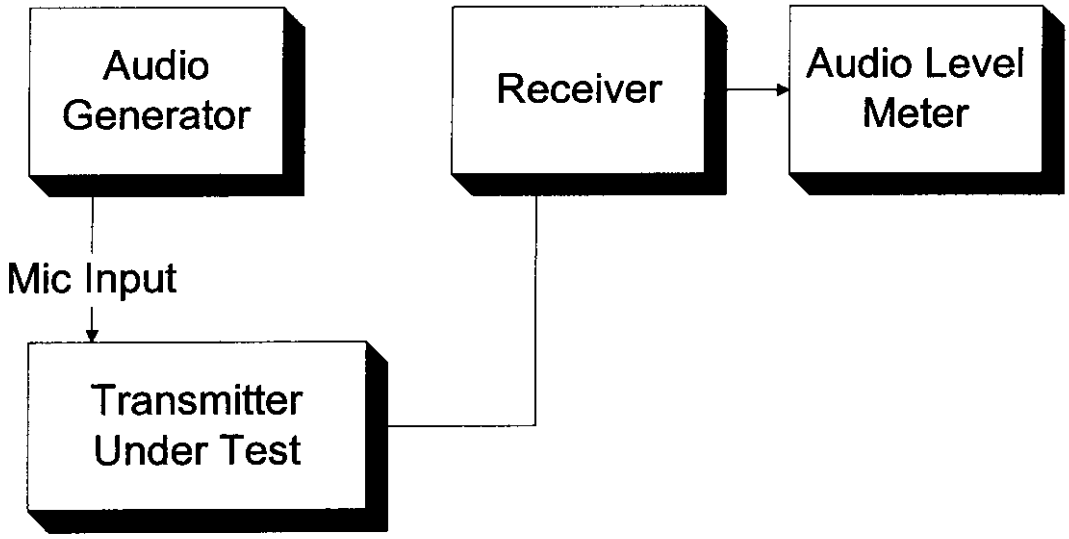
Para. No. 2.1046 - R.F. Power Output



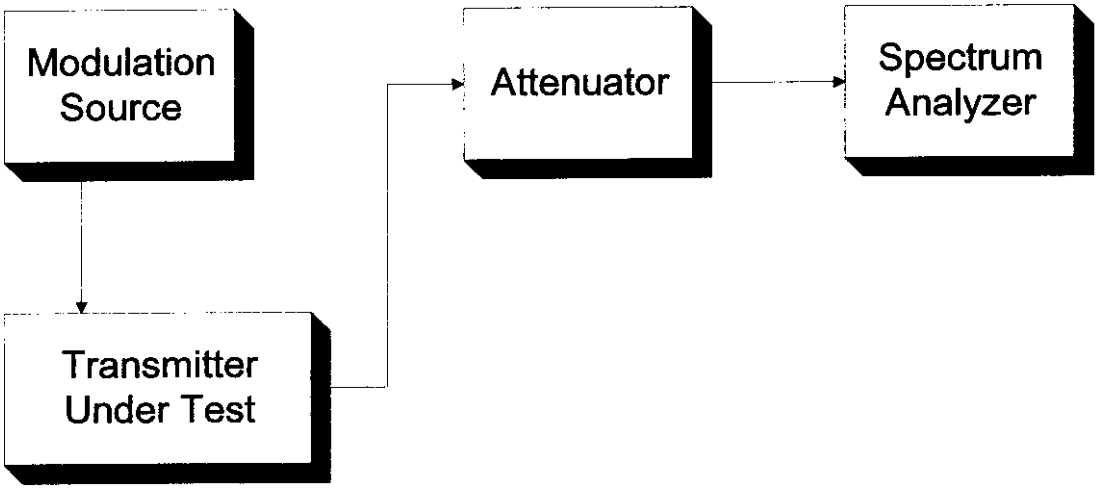
Para. No. 2.1047(a) - Audio Frequency Response



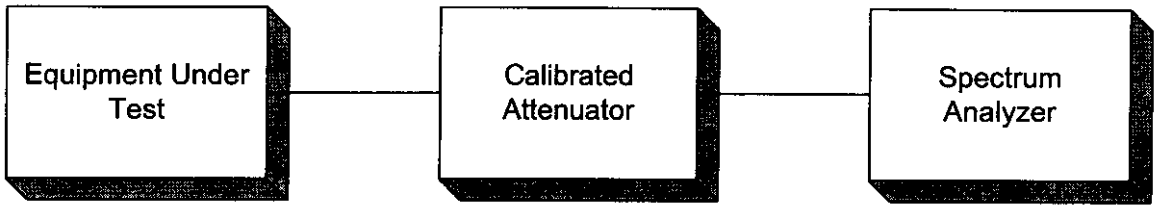
Para. No. 2.1047(b) - Modulation Limiting



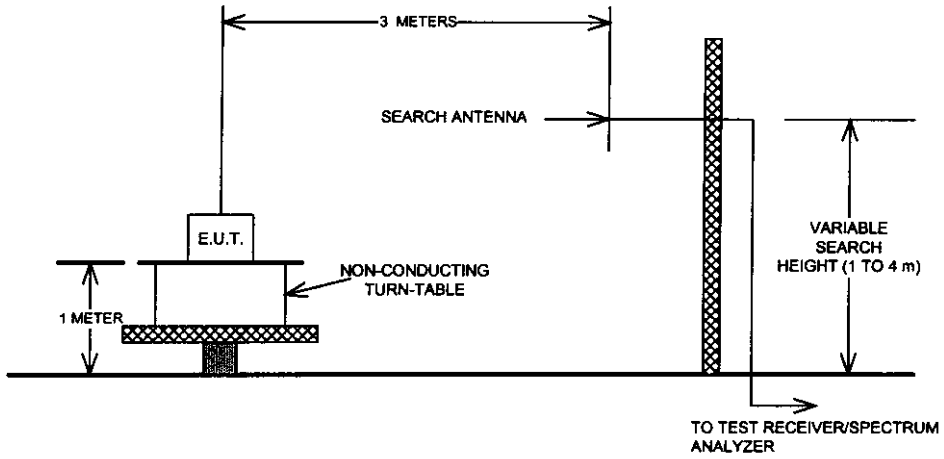
Para. No. 2.1049 - Occupied Bandwidth



Para. No. 2.1051 - Spurious Emissions at Antenna Terminals



Para. No. 2.1053 - Field Strength of Spurious Radiation



Para. No. 2.1055 - Frequency Stability